

## CIVIL AERONAUTICS BOARD

**ACCIDENT INVESTIGATION REPORT**

Adopted: April 25, 1952

Released: April 28, 1952

**AMERICAN AIRLINES, INC.,—ELIZABETH, NEW JERSEY, JANUARY 22, 1952****THE ACCIDENT**

American Airlines' Flight No. 6780, a Convair 240, N-94229, crashed in the City of Elizabeth, New Jersey, on January 22, 1952, at about 1543.<sup>1</sup> All twenty passengers and three crew members were killed, impact and ensuing fire destroyed the aircraft. Considerable damage resulted to buildings and seven persons therein were fatally injured.

**HISTORY OF THE FLIGHT**

Flight 6780 originated at Buffalo, New York, for Newark, New Jersey, with stops scheduled at Rochester, New York, and Syracuse, New York.<sup>2</sup> The crew consisted of Captain Thomas J. Reid, First Officer Lawrence S. Iudicello and Stewardess M. R. Siegle.

At Buffalo a flight plan under instrument flight rules was prepared and signed by the captain and the company dispatcher. It specified an altitude of 5,000 feet from Buffalo to Rochester, 5,000 feet from Rochester to Syracuse, and 7,000 feet from there to Newark, Albany, New York and Windsor Locks, Connecticut, were the alternates. Company weather data, attached to the flight plan, indicated that instrument conditions would exist over all three segments of the flight.

Departure from the Buffalo ramp was at 1203 and the aircraft was off the ground at 1214. Its gross weight was less than that allowable and its center of gravity was within prescribed limits. Flight was uneventful at the planned altitude of 5,000 feet. Landing at Rochester was at 1237 and the aircraft was at the ramp at 1241.

Departure from the Rochester ramp was at 1248 and the aircraft was off the ground at 1258. Again, its gross weight was less than

that allowable and its center of gravity was within prescribed limits. The planned altitude of 5,000 feet was maintained. At 1311 the flight contacted the company radio at Syracuse and was given the Syracuse weather including a visibility of three-eighths of a mile which was less than the landing minimum. The flight then, at 1312, contacted the Syracuse Tower and was cleared to descend to 4,000 feet and to hold east of the outer marker of the Instrument Landing System and to expect approach clearance at 1345, based upon an expected improvement in weather. Syracuse Approach Control then cleared the flight to the Syracuse Range Station and to hold west at 4,000 feet with the same estimated time for approach clearance. At 1318 the flight reported over the range at 4,000 feet, holding west. The next clearance was to the ILS Outer Marker and to hold at 4,000 feet. This was followed by clearance to descend to 3,000 feet followed by clearance to make an ILS approach. The ground visibility at this time (approximately 1330) had improved to above minimum and the flight landed uneventfully at 1334 reaching the ramp at 1339. This leg of the flight was routine with no reported irregularities of any nature, and the aircraft's ILS equipment functioned normally.

At Syracuse the captain went to the company's office, checked the weather, and advised the company agent that he saw no problem in regard to landing at Newark. The aircraft was fueled with 340 gallons bringing the total to 900 gallons. The gross weight out of Syracuse was 38,852 pounds or 936 pounds less than the maximum allowable of 39,788 pounds and the aircraft's center of gravity was within prescribed limits. The load consisted of 20 passengers, 85 pounds of mail, 112 pounds of air express and 400 pounds of ballast. The flight left the Syracuse ramp at 1351 and was off the ground at 1401. Albany and Windsor Locks were still listed as alternates.

<sup>1</sup>All times referred to herein are Eastern Standard and based on the 24-hour clock.

<sup>2</sup>The subject aircraft, with a different crew, had been flown from Boston, Massachusetts, to Buffalo, New York, as Flight 780. The destination was Chicago, Illinois, but bad weather to the west terminated this flight at Buffalo.

At 1421 the flight reported to Syracuse that it was over Cortland, New York (a compulsory reporting point), at 7,000 feet, its planned altitude. At 1446 it reported being over Lake Carey, Pennsylvania, also a compulsory reporting point, at 7,000 feet and estimated arrival over Branchville, New Jersey, at 1508. This transmission was to New York (LaGuardia) and on company frequency. At 1450 New York transmitted "Air Traffic Control clears Flight 6780 to maintain 7,000 feet, contact Air Traffic Control on 118.9 megacycles when over Branchville, no delay expected." At 1504 New York was advised of the change from company to ATC radio frequency. This indicated that the flight was then over Branchville and complying with the above instructions.

The flight reported over Paterson, New Jersey at 1521 at 7,000 feet. It was then successively cleared by ATC to 6,000 feet, to 5,000 to 4,000 and to 3,500 feet at which altitude it passed over the Newark Range Station at 1528. ATC then instructed the flight to change radio frequency to that of Newark Approach Control, 118.3 megacycles. This change was made and the next contact was with Newark Approach Control to which the flight gave its position as over Linden, New Jersey. The time of this transmission was not recorded.

Approach Control acknowledged and transmitted the Newark weather: Indefinite, ceiling 400 feet, obscurement, visibility 3/4 mile, light rain and fog, altimeter 29.97, expect approach clearance at 1540. The flight acknowledged this message.<sup>3</sup>

Next, the flight was cleared from 3,500 feet to 2,500 feet, to 1,500 feet, and informed that it could start its approach inbound from Linden at 1539. The flight reported leaving Linden inbound at 1541, and was instructed to listen to advisories from Ground Control Approach on the frequency of the localizer voice transmission and cleared to land on Runway No. 6 (the Instrument Landing System runway) the surface wind being from the northeast at four miles an hour.

The Ground Control Approach Radar at Newark includes a ten-mile precision scope and a three-mile precision scope. Both have two

<sup>3</sup> CAA approved ILS ceiling visibility and minimums for American Airlines Convair at Newark are 300 feet and 3/4 mile.

screens, an elevation screen showing vertical deviation, and an azimuth screen showing lateral deviation, from the ILS glide path. Advisory reports from the GCA to incoming aircraft are recorded, replies from the aircraft and the times of the advisory reports are not recorded.

Shortly after the flight left Linden inbound at 1541, the operator of the ten-mile scope transmitted

1. "American 6780, this is Newark radar. How do you hear? Over."

This was answered, according to the controller, with

"Roger, radar, I've been listening to you monitor 6720 and I hear you loud and clear." (6720 was another American Airlines Convair immediately ahead of 6780. It landed on Runway 6 at Newark using ILS and GCA at 1539.)

2. "6780, this is Newark radar, have you 5-1/2 miles out, coming up on the glide path, and you're 900 feet to the left of course."

3. "American 6780, 5 miles out, on the glide path, still 900 feet to the left of course."

4. "Coming back to the course now, you're now 400 feet left, glide path is good 4-1/2 miles out."

5. "300 feet to the left, you're coming back, you're right on course now, and your glide path is going a little high, 100 to 150 feet high on the glide path 4 miles out, the Court House 1 mile ahead of you."

6. "Glide path is good 3-1/2 miles out and you're drifting to the right, you're 900 feet to the right of course and 1/2 mile from the Court House."

Some four or five seconds after the last advisory, the aircraft vanished from both the azimuth and elevation screens of the ten-mile precision scope.<sup>4</sup> At about this time the operator of the three-mile precision scope saw no indication on either of its screens and transmitted that the aircraft was not in radar contact. Several requests to 6780 for

<sup>4</sup> See Attachment I, a diagram of the approach path as described by GCA operators (Exhibit No 35-A.)

its position were then transmitted, none was answered.

The aircraft crashed and burned at the approximate corner of the intersection of Williamson and South Streets in Elizabeth, New Jersey. This position is about 2,100 feet to the right (southeast) of the glide path and about 3-3/8 miles from the touchdown point on Runway No. 6.<sup>5</sup> Elevation of the impact site is about 37 feet above sea level, elevation of the Newark Airport is about 18 feet above sea level. The time of impact was determined to be approximately 1544

#### INVESTIGATION

Weather conditions along the route from Buffalo to Newark included a strong flow of southerly winds causing the advection of warmer air which was riding over a cooler air mass near the surface. Winds were eastward at the surface resulting in a wind shear and turbulence at the boundary of the two air masses. There were no fronts along the route.

Company forecasts available to the flight before departure from Buffalo were

Rochester, 1000 to 1600, ceiling 500, sky obscured, visibility 1/2, snow.

Syracuse, 1200 to 2200, ceiling 500, sky obscured, visibility 1/2, snow.

LaGuardia, Idlewild and Newark, 1300-1500, ceiling 500, sky obscured, 3/4 mile, snow, and from 1500 to 1700, ceiling 600, overcast, visibility 2, light snow, light sleet and freezing rain.

Albany and Windsor Locks, (alternate airports) 1500 to 1700, ceiling 400, sky obscured, visibility 1/2, snow.

Weather Bureau forecasts were generally similar to those of the company except for higher ceilings and visibility at the terminals. Icing was forecast above the freezing level and light to moderate turbulence was expected.

A study of all available meteorological information indicates the following conditions prevailed during the flight

<sup>5</sup> A point 1200' from the approach end of the runway from which the ILS glide slope emanates

Take-off at Buffalo was in light snow and very light sleet with a solid instrument condition above 3,000 feet. At 5,000 feet, the cruising level, winds were from about 200° at a velocity of about 55 miles per hour with light turbulence and possibly light ice. Landing and takeoff at Rochester were made under better than minimum conditions and conditions at 5,000 feet were similar between Rochester and Syracuse to those between Buffalo and Rochester. At Syracuse a delay occurred in landing due to a short period of below minimum weather.

On departure from Syracuse, solid instrument conditions were probably encountered a little above 1,000 feet. At 7,000 feet, the cruising level for that leg of the flight, solid instrument conditions existed with winds estimated from 210° at 55 to 60 miles per hour and a temperature of 25 to 30 degrees. Light turbulence and light icing were likely. During descent in the New York area above-freezing temperatures were encountered when the 5,000-foot level was reached and any ice that may have been on the plane had probably melted by the time 4,000 feet was reached. During this descent precipitation ranged from very light to moderate snow at 7,000 feet. At the lower altitudes it turned to drizzle with occasional moderate rain below 4,000 feet. By this time the boundary between the cooler surface air and the warmer air aloft had lowered to about 1,500 feet in the Newark area. This wind shear zone, extending from about 1,000 to 2,000 feet, was choppy and rather sharply turbulent but had only small vertical currents. Meteorological conditions definitely indicated that no downdrafts near the surface were probable as the cooler, denser air near the surface would tend to destroy descending currents. Also in this 1,000 to 2,000-foot zone the wind changed from about 210° at 50 miles per hour to about 140° at 30 miles per hour, thence decreasing in velocity and shifting in direction through 90° to about 45° during descent from 1,000 feet to surface. In the meantime weather reports showed that below minimums were existing at LaGuardia and Idlewild, ceiling was 700 and visibility 1-1/4 at Teterboro, and Newark was reporting indefinite ceiling 400, sky obscured, visibility 3/4, light rain and fog, temperature 33, dew

point 30, wind NE 8 and altimeter 29.97 (1525 E observation) Testimony of pilots who landed at or took off from Newark Airport near the time of the crash verify the reported ceiling and visibility. However, ground witnesses to the crash estimate that at the time and place of impact the ceiling was about 100-150 feet with a light drizzle, a visibility of two or three city blocks and little or no wind.

Conditions during the entire letdown and approach were favorable for carburetor icing. Pilots who landed just before and after the accident did not experience any carburetor icing, all but one stated that they used carburetor heat during their approaches to avert icing.

These pilots also verify that the weather conditions were substantially as forecast. Wind was strong from a generally southeast direction above about 1,000 feet altitude, causing a large amount of drift to the left. Below 1,000 feet the wind decreased with a practically calm condition on the ground. Ice above 4,000 feet and temperatures above freezing below 4,000 feet were reported, as was forecast.

During the approximate two-hour period from one hour before to one hour after the time of the accident, a total of 19 flights landed at, or took off from, the Newark Airport. Statements from their pilots indicate that all ground radio, navigational, and communications facilities were operating normally. These statements also indicate that the azimuth and elevation components of the instrument landing system were as published and that guidance by GCA Advisories was consistent with the direction of the localizer course and the angle of the glide path.

Subsequent flight checking of radio facilities at the Newark Airport by Board personnel, in both helicopter and fixed wing aircraft, revealed no irregularities in the functioning of either the ILS or the GCA systems.

Inspection of the company and CAA records disclosed no irregularities in the dispatching or in the conduct of the flight during any of the three route segments from Buffalo to Newark. Evidence disclosed that all radio contacts with the flight were normal and all compulsory position reports were made.

A routine chemical test, employing litmus paper, of the fuel supply from which the aircraft was serviced at Syracuse was negative (Water-free).

There were a number of ground witnesses to the final short portion of the flight and to the crash itself. Statements were taken from 26 persons who heard or saw the aircraft just before impact. While their accounts did not agree in all respects, the consensus is that the aircraft was flying at an altitude of 100-150 feet, just below cloud, in a generally easterly direction, for a distance of about three city blocks before it struck. Further, its attitude was generally described as level both longitudinally and laterally. Engine noise was variously described as "loud bangs, with a roar," "rumbling as it passed over," "sound of a car, when all spark plugs are not working," "the noise stopped, the pilot speeded up motors as loud as he could" etc.

One witness, Vincent J. O'Connell, who was standing in his yard at 325 Fay Avenue, Elizabeth, New Jersey, testified that he heard the aircraft approaching from the direction of Linden, which was southwest of his residence. Several seconds afterwards he heard an abnormally loud blast or backfire from one of the motors. The other motor seemed to be running smoothly. A few seconds after the first blast, another was heard and by that time the aircraft was close to where he was standing and seemed to veer sharply to the right. He stated that he detected this by the sound of the airplane as he could not see it due to the restricted visibility. As the aircraft was about overhead, a third blast was heard, the same as the preceding ones, and a yellowish glare was momentarily visible through the fog. One motor seemed to stop. The other which sounded normal increased in intensity and whined. It seemed as if a tremendous amount of power was being applied. A few seconds later a terrific explosion was heard in the distance and the witness assumed that the plane had crashed or hit something. The witness fixed the time as 1543 by his pocket watch when the aircraft passed over his point of observation.

Actual investigation of the wreckage of the aircraft and buildings reveals that the aircraft struck while about level laterally, on a heading of approximately  $90^{\circ}$  true, but

while in steep descent, with the nose raised appreciably. Marked localization of the wreckage further substantiated this nature of impact, i.e., with considerable vertical, but relatively little horizontal, speed.<sup>6</sup> There was no evidence of any fire in flight. A protracted and highly destructive ground fire eliminated a great deal of physical evidence pertaining to aircraft structure and power plants. It was nevertheless possible to learn certain conditions existing prior to impact.

A thorough search, by helicopter, of tops of buildings back along the flight path, and of the ground area, failed to yield any part or component of the aircraft that had left the structure prior to impact.

Examination of the engines revealed no indication of any malfunctioning or failure of either. All six propeller blades were recovered at the scene of the accident. The propeller pitch positions were checked carefully. At the time of impact the blades of the left propeller were at a pitch angle of about 33 degrees and those of the right propeller were at a pitch angle of about 41 degrees. A study of the propeller governors indicates that both were set to allow their respective engines to run at about 2270 R.P.M.

Examination of the aircraft structure revealed that the landing gear was extended and that both flaps were extended equally about 25 degrees at the moment of impact. The aileron tab actuators were not found but the aileron tab position indicator on the control pedestal was within the normal operating range. The trim tab actuators for both elevator and rudder were found and both were in the normal range for approach configuration. Other readings and settings of various controls and indicators were either not obtainable or considered too unreliable to allow any interpretation. Nothing was found to suggest any failure of any part of the aircraft's structure or any malfunctioning of its control system prior to impact.

All major units of the electronic communications and navigation equipment aboard the aircraft were recovered. Although all were severely damaged by impact and/or fire, no

evidence of internal failure was found in any of them. All of the obtainable readings of indications on directional instruments, frequency dial settings and switch positions of the recovered units indicated normal use of these units for a normal ILS approach, with GCA monitoring, to Runway No. 6 at the Newark Airport. Maintenance records for all units were examined and found to be in good order, none showed any peculiar service difficulties.

Likewise, all maintenance and operational records of the aircraft, its engines and its propellers were carefully studied. No item was found, however, to indicate any condition or history of any component that might have been significant in relation to this accident.

The aircraft's path was plotted, based on GCA advisories and testimony of the operator who issued those advisories to the flight. It indicates that progress down the glide path was not unusual, and deviations were not abnormal, until all indication of the aircraft vanished from the screens.<sup>7</sup> This occurred four or five seconds after the last advisory that the flight was three and one-half miles from touchdown, 900 feet to the right of course, and at the proper elevation. (Proper elevation at that point is about 900 feet.) The elevation scope can track an aircraft no lower than about 400 feet in the general accident area because of radar interference from ground objects, buildings, etc.

Investigation disclosed that Captain Reid had made a total of 17 ILS approaches, of which six were at Newark, since October 1, 1951. During the same period, First Officer Iudicello had made a total of 15 ILS approaches of which three were at Newark.

#### ANALYSIS

It is concluded that this accident was not attributable to any malfunctioning of the ILS or GCA equipment at the Newark Airport because both functioned properly for flights immediately before and after the accident as well as during subsequent, exhaustive tests. It is also concluded that the aircraft's ILS equipment was working properly inasmuch as nothing was found to indicate otherwise and also because Flight 6780 had made an uneventful ILS approach at its last stop, Syracuse,

<sup>6</sup>See Attachment II, a sketch of the impact site (Exhibit No 40-D)

<sup>7</sup>Refer to Attachment I

only two hours and 10 minutes earlier. No irregularity of any nature in the operation of the aircraft's ILS equipment was reported.

Pressure change from the time that the last altimeter setting was given to the flight to the time of the crash could not account for more than 20 to 30 feet of altitude. Furthermore, the flight was on the glide path and with advisories, any altimeter error should have been inconsequential. The change of wind direction and velocity in the 1,000 to 2,000-foot zone caused more than usual, but not extreme changes of heading. No meteorological factors existed that should have been much more than routine in navigating and making an approach for landing during instrument and near minimum conditions.

Although it is impossible to determine accurately the exact path of the aircraft from the time it was last seen on the GCA screens until it crashed, the following reconstruction of its most probable path can be made. The accident undoubtedly had its inception just before the last screen observation, which was four or five seconds after the last advisory report. That report placed the aircraft 900 feet to the right of course, at the proper altitude (about 900 feet), and three and one-half miles from touchdown. Four or five seconds later, when the aircraft disappeared from the GCA screen, it must have been at least 500 feet lower because it could have been tracked to 400 feet altitude. This rate of descent (500 feet in 4-5 seconds) is abnormally high, approximately 6,000 feet per minute. The cause of such extreme rate of descent can most readily be attributed to an unsymmetrical power, and consequently thrust, condition.

Because the aircraft was last seen by ground witnesses headed in an easterly direction paralleling South Street, it must have turned approximately 40 degrees to the right from the point it was last seen on the GCA screen. This fact is supported by the testimony of O'Connell who thought from the sound of the engines that the aircraft was turning to its right. That the aircraft did turn to the right is substantiated by Mr. Michael Calabrese, the first ground witness who actually observed it directly overhead below the overcast.

The aircraft was seen to be flying level for about three city blocks, at an altitude

of 100-150 feet before it struck. The "about three city blocks" is a most elastic distance, but it measured about 1300 feet, therefore the point of the aircraft's emergence below the 100-150 foot overcast would be approximately 400 feet beyond the point where it vanished from the GCA screens.

Because the azimuth screen of the 10-mile precision scope could have tracked the aircraft from a considerable distance still farther to the right than where it was last seen, we must conclude that disappearance from both screens occurred when the aircraft went below the 400-foot level, below which it could not have been tracked because of the ground interference.

As stated, the times of GCA advisories are not recorded, and it is thus not possible to know the time interval from the last advisory to the crash time which was determined to be about 1544. However, the aircraft's last position report was at 1541, over Linden, approximately three miles back along the approach path from the crash site. Because times are recorded at the previous full minute, a precise time-distance computation cannot be made. (Three miles in three minutes is an impossibly low air speed for the aircraft involved.) But it appears probable that there could have been no manner for the aircraft to descend from some 900 feet to 100-150 feet except at an extremely high settling rate.

It has previously been stated that examination of the undestroyed portions of the wreckage revealed nothing that reflected upon the integrity of the aircraft's structure, its engines, or its propellers. Further, the weather, as far as can be learned from exhaustive study, was not of a degree of severity to cause such rapid descent because of downdrafts or to cause the aircraft to stall because of violent and abrupt wind changes. We must, therefore, because of the lack of physical evidence advance certain conjecture as to the cause of the aircraft's rapid descent.

The possibility of a bird strike was considered and rejected for several reasons. First, there was no evidence of bird remains on any of the recovered parts of the windshields or their frames. Although none of the left windshield was identifiable, the right one was nearly intact indicating that any bird strike incapacitating the pilot on

the left should not have affected the pilot on the right. Further, birds never fly in solid overcast conditions as far as is known.

One possible cause of the aircraft yawing sharply to the right and losing altitude quickly would be unequal extension of the two wing flaps. However, examination of the fractures in the flap torque tubes indicated that they were intact until the aircraft disintegrated and that, as a result, the flaps were equally extended until disintegration at impact. Aside from this, any failure in the flap system would be likely only during the retracting or extending cycle which places much higher stresses in the torque tubes than do flight loads. It follows then that if unequal flap extension had resulted in loss of control the accident should have happened much farther back along the flight path near the point where the flaps are normally extended. These facts allow the exclusion of unequal flap extension as a reason for the aircraft's maneuver.

Another possibility is that of carburetor icing. It has been pointed out that ground witnesses, all laymen, reported hearing unusual and varied engine noises. If during the descent and at about the time the aircraft vanished from the screens one or both carburetors had been iced, and if at that time more power had been required of the engines, it is conceivable that there could have been a power surging, presumably of the right engine inasmuch as the aircraft went to the right during descent. This would cause unusual engine noise. If surging had occurred, it would have taken some time for the crew to effect corrective action, and during that time the speed of the aircraft may have decreased to a marginal value with a consequent high sinking rate. However, it is difficult to reconcile the possibility of icing with other facts. First, the carrier's operations manual sets forth explicitly that carburetor heat shall be used, to the extent of raising the air temperature to 40°C during periods of visible precipitation. It was raining at the time and place of the accident. Further, it appears most likely that a carburetor icing condition existed during the earlier part of the descent below the 4000-foot level. If so, there is little doubt but what carburetor heat would have been used to avert icing starting at the

4,000-foot level. Most of the other flights landing at Newark during the general time period did use carburetor heat. The pilot of another Convair, operated by the same carrier, landed at Newark only five minutes before the accident, he testified that he had used carburetor heat as prescribed by his company's operation manual. The subject aircraft was equipped with an alcohol system as a second means of removing carburetor ice.

It may also be pointed out that the company's operations manual calls for a complete pre-landing check before the aircraft starts inbound from Linden. This covers a number of items including checking for the need of carburetor heat. In conclusion, all factors, the company's procedures, the pilot's training and experience, and the existing weather conditions point to the probability that the pilot did use carburetor heat. There is no single bit of evidence to suggest that he did not, except that of witnesses who heard varying engine noises including three loud blasts accompanied by yellow glare, suggestive of backfire and engine surging, that could have been caused by faulty carburetion due to carburetor ice. The characteristics of the subject engine in regard to icing of its carburetor preclude the possibility of any significant ice accretion during the three or four minutes following the time of the compulsory landing check. However, carburetor ice may have existed during cruise and descent prior to the time that the compulsory pre-landing check would have been made, due to non-use of, or inadequate carburetor heat. This may not have been indicated since power requirements were progressively reduced during the descent and weather conditions were conducive to carburetor icing below the 4,000-foot level accompanied by saturated air and rain. If there was still no indication of carburetor ice at the time of the pre-landing check and no additional carburetor heat was applied while power was still being reduced for the final approach, it is possible that ice accretion could have increased and at a more rapid rate.

GCA monitoring indicated that the aircraft was making a normal ILS approach, which was indicative that the power settings and rate of descent had been stabilized. Had more power been applied to compensate for deviations in azimuth and sharp turbulence, which

existed during the final approach, and carburetor ice accretions were present, such increase of power probably would have precipitated backfiring and surging of either or both engines with attendant loss of power and altitude.

A continuous surging of large displacement engines, such as the type involved, would affect controllability and air speed adversely, particularly in view of the fact that the landing gear and wing flaps were extended, which would result in the loss of air speed to a marginal value. This condition, together with the effect of the near maximum gross weight (approximately 36,234 pounds) and high wing loading could have precipitated a high settling rate.

Witnesses heard and/or observed the aircraft in near level attitude during the final portion of the flight which indicates that the rapid rate of descent had been checked. With the 100 to 150-foot ceiling and poor visibility existing due to fog and rain, it is evident that forward visibility from the cockpit was greatly restricted, although some witnesses saw the aircraft during its final approximate 1,300 feet of flight. A number of these witnesses observed the impact. From their observations and the analysis of the physical evidence at the scene, including the damage to buildings, it is concluded that the aircraft struck in a very steep descent and crashed through the roofs.<sup>8</sup> The damage to the aircraft and extreme localization of the wreckage distribution at impact indicates that the longitudinal axis of the aircraft was at a high positive angle of attack relative to the descent path. If the aircraft was in a level attitude, during the final 1,300 feet, as the witnesses described, it appears that there was not sufficient power being generated to avoid settling into the buildings.

The possibility of a propeller reversing its pitch has been studied. Normally, pitch is reversed for ground braking, and an electrical switch incorporated in the landing gear allows the propellers to be reversed after the hydraulic landing gear oleo strut has been compressed approximately one-half inch. This movement, resulting from the aircraft's weight on its wheels, closes the

switch, which energizes a solenoid. This, in turn, unlocks the throttle reversing mechanism, thus permitting rearward movement of the throttles into the reverse propeller pitch position.

The throttle lock on the reversing mechanism can also be normally operated from within the cockpit. This is done by pulling out a "T" handle manual override control. This control is spring loaded, and normally stays in when the aircraft is in flight. It is connected mechanically to the solenoid plunger and its outward movement has the same effect on the throttle lock as does the energizing of the solenoid. The "T" handle is plainly placarded, "The manual override must not be used until the airplane is firmly on the ground" American Airlines' operating manual, as well as a mechanical check list mounted in the cockpit, both list checking the position of this manual override switch prior to landing. The object is to prevent unintentionally pulling the throttles back into the reverse pitch range during flight.

Propeller pitch reversal in flight on the subject aircraft would involve malfunctioning of the reversing system. Careful inspection of the propellers and their reversing systems failed to disclose any evidence of malfunctioning that would be indicative of a reversal in flight.

As stated, the blades of the left propeller were determined to have been at 33° pitch at the time of impact, those of the right propeller to have been at 41°. Both propeller governors were found set to allow their respective engines to run at about 2270 RPM, considered within the normal range for approach. The pitch setting of the left propeller, 33°, was considered within the normal range for an approach, however, the pitch setting of the right propeller, 41°, was considered too high. A logical explanation of this high pitch setting is that the right engine surged. This would result in alternating decrease and increase of engine RPM of probable increasing magnitude. A power surge could result in a peak RPM higher than that for which the governor was set. The governor, sensing only RPM, would then increase the pitch to reduce the RPM to its setting. This governor reaction and resultant propeller blade change lags in relation to any appreciable change in RPM. At the moment of impact, the propeller blades could have been at

<sup>8</sup> See Attachment II

this high blade angle, as found, due to the action of the governor to decrease RPM.

It appears that the company dispatcher should have designated additional alternates prior to the flight's departure from Syracuse, since the company forecast at Buffalo predicted Albany and Windsor Locks would go below alternate minimums after 1500<sup>9</sup>. Although these alternates were below minimums at the time the flight arrived in the Newark area, the flight had sufficient fuel aboard to proceed to other suitable alternates or return to Syracuse, had Newark weather conditions required the flight to do so. Upon arrival at Newark, the aircraft's fuel tanks should have contained about 600 of the 900 gallons of fuel on board upon departing Syracuse.

The possibility of crew incapacitation was considered unlikely. The last radio contact with the flight was at 1541 and since the accident occurred at 1544, there was no indication that either the captain or the copilot was incapacitated in any respect. Moreover, all contacts with the flight indicated a routine operation and at no time was an emergency declared. The crew had had adequate rest periods and both pilots held currently effective medical certificates.

Investigation of this accident determined that the carrier's operating procedures, in general, including its training for Convairs, were consistent with good and accepted practices.

All evidence points to the fact that the aircraft was airworthy on departure from Syracuse, and that the crew was fully qualified in the aircraft and over the route involved. The captain, by virtue of his experience, undoubtedly was familiar with the terrain and the navigational facilities in the Newark area. In fact, the operation of the flight can be considered normal until after its last report at 1541, when GCA was advised that its signals were loud and clear. The aircraft's maneuvers during the first portion of the glide path traversed were described as being normal, however, the Board, as previously stated, can only conjecture as to what might have caused the sharp descent and right turn. Whatever happened during the very short period of time before impact was of such nature that it was beyond the capabilities of both pilots to effect complete recovery.

<sup>9</sup>See Civil Air Regulations Sections 61.203 and 61.204

Although the facts are inconclusive as to the probable cause of this accident, there is some evidence to indicate that carburetor icing, followed by severe surging, occurred.

#### FINDINGS

On the basis of all available evidence the Board finds that

1. The company, the aircraft and the crew were properly certificated.
2. The gross weight of the aircraft was within its certificated limits and the load was properly distributed.
3. The flight was planned and dispatched under instrument flight rules in accordance with approved operating procedures.
4. The flight was routine from Buffalo and was cleared to descend and make an ILS approach, monitored by GCA, to the Newark airport.
5. Weather conditions below the 4,000-foot level at Newark were favorable to the formation of carburetor ice.
6. The flight reported over Linden, New Jersey, at 1,500 feet inbound to the airport at 1541.
7. The Newark weather conditions at 1540 were reported as indefinite ceiling 400 feet, obscurement, visibility 3/4 mile, light rain and fog, altimeter 29.97.
8. The aircraft vanished from the GCA screens at a point approximately 900 feet to the right of the glide path and while at an altitude of 400 feet, due to ground interference.
9. The weather information indicated lower ceilings and visibilities near the scene of the accident (about three miles southwest of the airport) than were reported at the airport.
10. The aircraft was headed in an easterly direction, below the overcast, in a near level attitude, for a distance of approximately 1,300 feet, before it crashed into buildings.

#### PROBABLE CAUSE

The Board determines that there is insufficient evidence available at this time upon which to predicate a probable cause.

BY THE CIVIL AERONAUTICS BOARD

/s/ DONALD W NYROP  
/s/ OSWALD RYAN  
/s/ JOSH LEE  
/s/ JOSEPH P ADAMS  
/s/ CHAN GURNEY

# Supplemental Data

## INVESTIGATION AND HEARING

The Civil Aeronautics Board's Investigator-in-Charge of the New York area was notified of the crash about 10 minutes after occurrence by a telephone call from an official of Union County, New Jersey. An investigation was started at once in accordance with the provisions of Section 702 (a) of the Civil Aeronautics Act of 1938, as amended. A public hearing ordered by the Board was held at Elizabeth, New Jersey, on March 4, 5 and 6, 1952.

## AIR CARRIER

American Airlines, Inc., is a Delaware Corporation with general offices in New York, New York, and operates as an air carrier under currently effective certificates of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. These certificates authorize the company to transport by air persons and property over many routes within the continental limits of the United States, including the route between Buffalo, New York, and Newark, New Jersey.

## FLIGHT PERSONNEL

Captain Thomas John Reid, age 33, held a currently effective airline transport

certificate with an appropriate rating for the subject aircraft. He had been with American Airlines since February, 1943, when he was employed as a student pilot. He had learned to fly two years previously. Captain Reid flew various types of aircraft for American Airlines and was checked out as a Convair Captain in April, 1951. At the time of the accident he had had 7,062 hours of piloting, of which 2,483 had been in Convairs, and had been qualified over the Buffalo-Newark route.

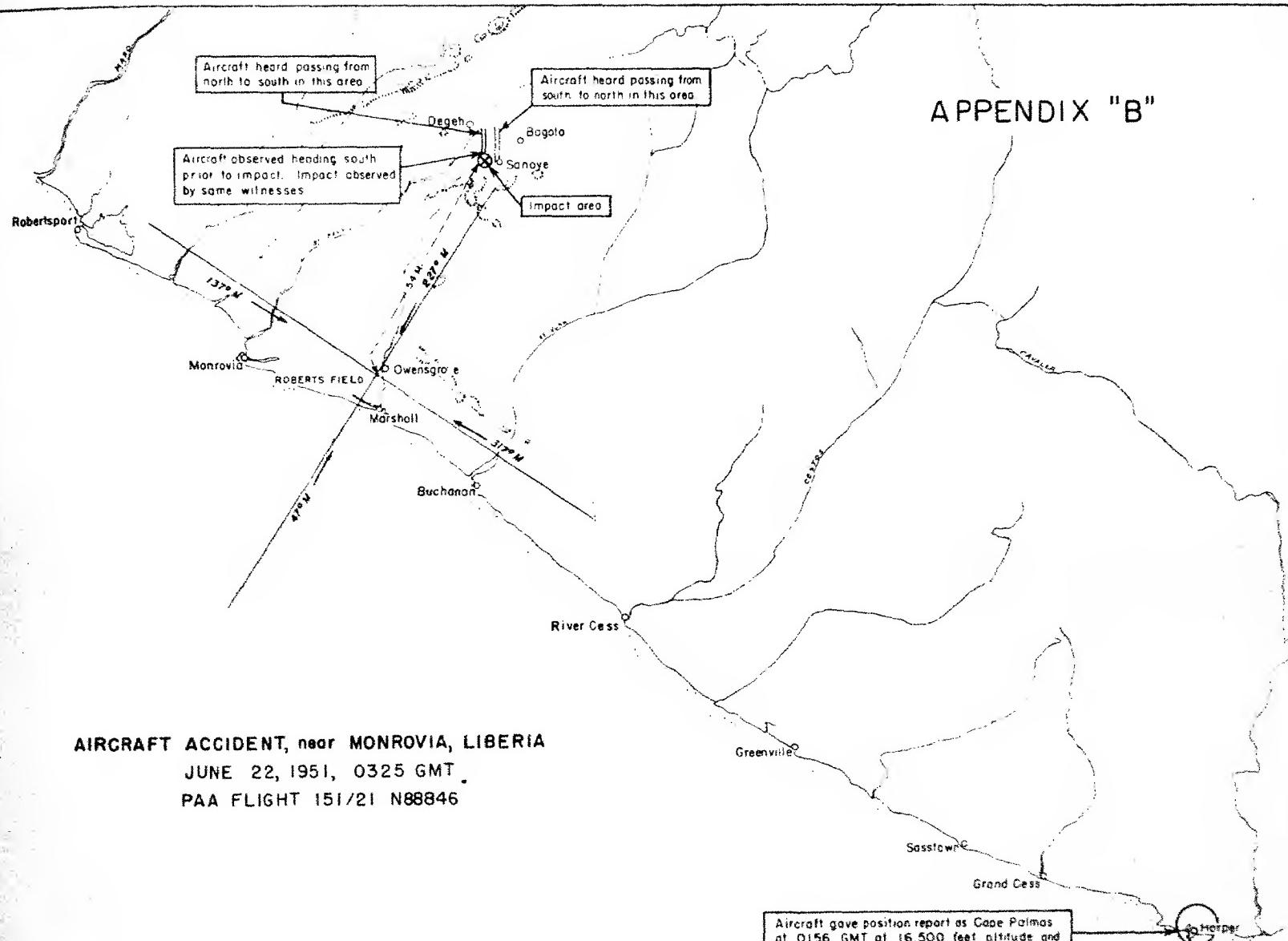
First Officer Lawrence Samuel Iudicello, age 29, was first employed by American Airlines in February, 1951, as a Flight Engineer Trainee. He held an airman certificate with commercial and instrument ratings. He had flown a total of 2,174 hours, of which 405 hours had been in Convairs.

The stewardess was Miss Mary Ruth Siegle, age 22. She had been employed by the company since June, 1951.

## THE AIRCRAFT

N-94229 was a Convair CV 240, manufactured by the Consolidated Vultee Aircraft Corporation in 1948. It was equipped with Pratt & Whitney engines, Model R-2800-83-Am-3, and Hamilton Standard constant speed propellers. At the time of the accident the aircraft had a total flying time of 6,633 hours.

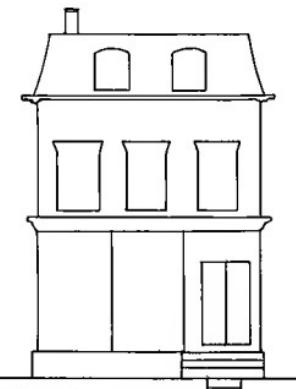
## APPENDIX "B"



AIRCRAFT ACCIDENT, near MONROVIA, LIBERIA

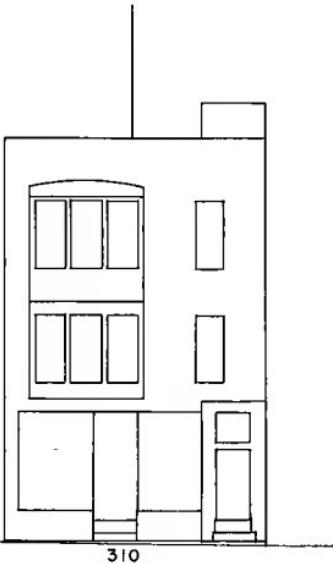
JUNE 22, 1951, 0325 GMT

PAA FLIGHT 151/21 N88846



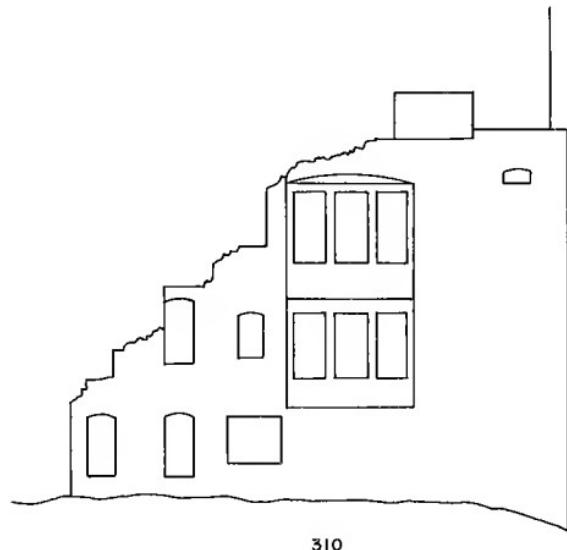
306

WEST ELEVATION



310

SCALE 1" = 10'



310

NORTH ELEVATION

JOHN W MEIXELL JR COUNTY ENGINEER  
FEBRUARY 1952

39400

EL E V A T I O N O F B U I L D I N G S S T R U C K  
BY A A L A I R C R A F T N 9 4 2 2 9  
JAN 22, 1952